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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/814,424	03/21/2001	Francisco A. Leon	42390.P11005	4073

7590 08/19/2003

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EXAMINER	
SONG, MATTHEW J	
ART UNIT	PAPER NUMBER
1765	

DATE MAILED: 08/19/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

MK-11

Office Action Summary	Application No.	Applicant(s)	
	09/814,424	LEON ET AL.	
	Examiner	Art Unit	
	Matthew J Song	1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *16 June 2003* .

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-21* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-21* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) *8* .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

2. Claims 1-3, 5 and 16-18 are rejected under 35 U.S.C. 102(b) as being anticipated by Huang et al (US 5,956,598).

Huang et al discloses a semiconductor substrate **300** is prepared, a pad oxide layer **302**, this reads on applicant's cladding material, over the substrate, a mask layer **304** of silicon nitride over the pad oxide layer, this reads on applicant's material, a photoresist layer is coated thereon and is then selectively removed and an anisotropic dry etching process, this reads on applicant's vertical etch, is performed to etch away the unmasked portions of the mask layer **304**, the pad oxide layer **302** and the substrate **300**. Huang et al also discloses a trench **306** is formed through this process, this reads on applicant's selectively removing portions of a material to obtain a region that defines a corner. Huang et al also discloses a pre-liner cleaning process is performed on the exposed surfaces of the substrate in the trench with RCA-A and a 10:1 solution of deionized water and hydrofluoric acid and during this process a small edge part of the pad oxide layer is etched away, resulting in the forming of a sharp corner **307**, this reads on applicant's

further removing portions of the materials from the region of the material to sharpen the corner. Huang et al also discloses an insulating material, such as silicon dioxide, is deposited through a CVD process into the trench (col 3, ln 55 to col 4, ln 67)

Referring to claim 2, Huang et al discloses an anisotropic dry etch (col 4, ln 1).

Referring to claim 3, Huang et al discloses a photoresist layer (col 3, ln 60-67).

Referring to claim 5, Huang et al teaches a wet etch is isotropic (col 4, ln 45-55).

Referring to claim 17, Huang et al is silent to etching the cladding material to define a rounded corner. However, this is inherent to Huang et al because Huang et al teaches a similar anisotropic etching through a photoresist, as applicant, therefore a rounder corner is inherently formed.

Referring to claim 18, Huang et al discloses depositing an insulating material, this reads on applicant's core material, in the trench.

3. Claims 1 and 5 are rejected under 35 U.S.C. 102(e) as being anticipated by Lin et al (US 6,194,285).

Lin et al discloses a silicon substrate **10**, a pad oxide **20,** this reads on applicant's material, and nitride surface coating **30** thereon and a window **40** is photolithographically defined in the surface coating **30** and a trench is etched, defined by the window. Lin et al also discloses the intersection of the oxide layer, this reads on applicant's cladding material, and the trench forms a corner **17** and the trench and window are then filled with an insulator **50**. Lin et al also teaches the insulator is then polished, stopping on the surface coating. Lin et al also discloses during isotropic wet etches process, a sidewall **55** retreats to **53** while a groove like

recess is formed and a corner becomes sharpened further (col 1, ln 40-67), this reads on applicant's further removing portions of the materials from the region of the material to sharpen the corner because the sidewall is made of the layers **20** and **30** (Figs 1a-1f).

Referring to claim 5, Lin et al teaches an isotropic wet etch.

4. Claims 1-7, 17-18 and 21 are rejected under 35 U.S.C. 102(e) as being anticipated by Pan (US 6,322,634).

In a method of forming a shallow trench, Pan discloses a silicon substrate **102**, a dielectric layer **104** of silicon dioxide and a buffer layer **106** of silicon nitride, this reads on applicant's material, where the silicon dioxide and silicon nitride layers are formed by chemical vapor deposition (col 3, ln 40-57). Pan also discloses a photoresist mask **108** is applied over the buffer layer and patterned using photolithographic patterning techniques and the buffer layer and the dielectric layer are then etched by standard etching techniques to form a patterned recess **110**. Pan also discloses the silicon substrate is then dry etched, this reads on applicant's vertical etch, to form a shallow trench, this reads on applicant's corner, and the photoresist mask is stripped to form a trenched structure (col 3, ln 58 to col 4, ln 5). Pan also discloses after stripping the photoresist and cleaning with H_2O_2/H_2SO_4 or H_2O_2/HCl a thin layer of oxide is grown in the shallow trench. Pan also teaches the buffer layer is wet etched using HF and the trench is then filled with an isolation material **122** of silicon dioxide formed by chemical vapor deposition (col 4, ln 6-30). Pan also discloses the isolation material is removed down to the buffer film layer by chemical mechanical planarization (col 4, ln 31-67).

Pan et al is silent to further removing portions of the material adjacent to the region to sharpen the corner. However, Pan does teach a cleaning step after the trench formation and a wet etching using HF, therefore portions of the material from the region of the material are inherently removed, sharpening the corner because Huang et al (US 5,956,598) and Lin et al (US 6,194,285) teach a corner being sharpened by using a wet etchant, as discussed previously.

Referring to claim 2, Pan discloses a dry etch, this reads on applicant's anisotropic etch.

Referring to claim 3 and 21, Pam discloses a photoresist mask **108**.

Referring to claim 4, Pan discloses removing the photoresist prior cleaning and etching with HF.

Referring to claim 5, Pan discloses a conventional wet etchant of HF, this is inherently an isotropic etch, as taught by Lin et al (US 6,194,285).

Referring to claim 6-7, Pan discloses an isolation material and chemical mechanical planarization, this reads on applicant's chemical mechanical polishing method.

Referring to claim 17, Pan discloses a buffer layer of silicon nitride, this reads on applicant's cladding material, and etching the buffer layer with HF. Pan is silent to the etching to define a rounded corner, however this is inherent to Pan because Pan teaches a similar etching method, as applicant, therefore inherently forms a rounded corner.

Referring to claim 18, Pan et al discloses depositing silicon dioxide in the trench, this reads on applicant's core material.

5. Claims 8-10 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Pan (US 6,322,634) in view of Binkley et al (US 6,022,671).

Pan discloses all of the limitations of claim 8, as discussed previously, except placing a third material over the second material.

In a method of forming a hybrid waveguide by a trench based manufacturing process, Binkley et al teaches shallow trenches are cut into a material and filled with either a core ore a cladding material. Binkley et al also teaches a photolithographic process and associated etch produces an open trench and these trenches are filled with a material and subsequently planarized by using chemical mechanical polishing. Binkley et al also teaches a core material **111** is deposited to fill a set of trench openings and a second cladding layer **118** is applied thereon (col 11, ln 1 to col 12, ln 67 and Fig 6A-J).

It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Pan with Binkley et al's method of filling a trench and depositing cladding layers to form a optical waveguide because an optical waveguide is useful in the communications industry (col 1, ln 1-30).

6. Claims 11-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Pan (US 6,322,634) in view of Ido et al (WO 98/37445), where US 6,229,949 is used as an accurate translation and a translation of WO 98/37445 can be provided upon request.

Pan et al discloses all of the limitations of claim 11, as discussed previously, except he corner comprises part of Y-branch of an integrated optical device.

In a method of making an optical waveguide by etching a substrate, note entire reference, Ido et al teaches a silicon substrate **1** having a SiO_2 film **40** and etching a portion of a core layer by reactive oxygen ion etching so as to from a waveguide pattern including Y branching

structures and then an upper clad layer **4** is coated (' 949 col 7, ln 1-50 and col 1, ln 10-65). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Pan with Ido et al's pattern to form a optical waveguide useful in an optical communication apparatus ('949 col 7, ln 39-50)

7. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Pan (US 6,322,634) in view of Nakos et al (US 6,054,745).

Pan discloses all of the limitations of claim 13, as discussed previously, except the corner comprises part of one of a microelectromechanical structure device (MEMS), a photonic crystal device, or a photonic bandgap device.

In a method of forming a microelectromechanical switch, note entire reference, Nakos et al teaches a fabrication process for the microelectromechanical switch, this reads on applicant's MEMS, using a shallow trench isolation (STI) structure **24** (col 4, ln 45-67). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Pan's shallow trench isolation structure with Nakos et al's method of forming a microelectromechanical switch using shallow trench isolation structure to form a switch useful in a nonvolatile memory cell structure (col 4, ln 45-60).

8. Claims 14-15 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Pan (US 6,322,634) in view of Kleinknecht (US 4,039,370).

Pan discloses all of the limitations of claim 14, as discussed previously, except forming a diffraction grating pattern having pillars of a substantially same radius as the corner to be

sharpened as the corner to be sharpened; illuminating the pillars with a light and detecting light diffracted from the pillars; removing the pillars concurrently with removing portions of the material adjacent to the region and determining if sufficient time ha elapsed to sharpen the corner based on the detected light diffracted from the pillars as they are removed.

In a method of optically monitoring a layer being etched, note entire reference, Kleinknecht teaches a layer **10** of silicon dioxide disposed on a substrate **12** and the layer **10** is selectively etched through an opening in a pattern **16** of a masking material, such as a photoresist, disposed thereon (col 1, ln 65 to col 2, ln 30). Kleinknecht also teaches optically monitoring the amount of undercutting of the layer **10**, while being etched in the etchant using a diffraction grating pattern **26** including spaced strips of masking material with different widths, this is interpreted to by the examiner to read on applicant's pillars of same radius of the corner (col 2, ln 31 to col 3, ln 15. Kleinknecht also teaches exposing a diffraction grating pattern to a beam **38** of light and monitoring a diffracted beam by utilizing photodetectors (col 3, ln 15 to col 4, ln 13). Kleinknecht also teaches a diffraction grating pattern immersed in an etchant **48** and monitoring diffracted beams of light (col 5, ln 15-67). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Pan with Kleinknecht's diffraction grating to monitor an etching process to provide in-process control and a desired amount of undercutting (col 6, ln 35-55).

Response to Arguments

9. Applicant's arguments filed 6/16/2003 have been fully considered but they are not persuasive.

In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., removing additional portions of the substrate, note pg 9, ln 1-4) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

Applicant's argument that Huang does not teach further removing additional portion of the substrate is noted but is not found persuasive. Claim 1 does not require the removing additional portions of the substrate, as suggested by applicant. Claim 1 recites, "lithographically patterning a corner over a material", note line 2. Huang teaches a pad oxide layer **302** is removed in an etching step and a small edge part of the pad oxide layer is etched away in a pre-liner cleaning step, this reads on applicant's further removing portions of the material from the region of the material to sharpen the corner, where the pad oxide layer reads on applicant's material.

Applicant's argument that Lin does not teach further removing portions of the material from the region of the material to sharpen the corner is noted but is not found persuasive. Lin teaches a pad oxide **20** and a nitride coating **30** on a substrate and etching a trench and the trench corner **17** becomes sharpened further when the sidewall **55** retreats, this reads on applicant's further removing portions of the material from the region of the material to sharpen the corner because the sidewall is composed of layers **20** and **30**, which read on applicant's material.

Applicant's argument that Pan does not disclose further removing portions of the material from the region of the material to sharpen the corner has been considered but is not found persuasive. Pan discloses etching a trench into a buffer layer **106** and an oxide layer **120**, these

layers read on applicant's material. Pan also discloses cleaning the structure using acids. The examiner admits that Pan does not explicitly teach further removing portions of the material from the material to sharpen the corner, however this feature is held to be inherent to the invention taught by Pan. The feature is inherent because Pan teaches cleaning the trench using wet etchants and Huang and Lin teach sharpening a corner by using a wet etchant; therefore because Pan teaches a similar step of using wet etchant on a similar layer as Huang and Lin, the corner is inherently sharpened, as taught by Huang and Lin.

Conclusion

10. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Wang et al (US 2002/0136518) teaches forming a waveguide by etching and filling with a core material (Abstract).

Van der Tol ("Sharp Vertices in Asymmetric Y-Junctions by Double Masking") teaches a double heterostructure on an InP substrate and a reactive ion etch is used to obtain sharp vertices in asymmetric Y junctions, this reads on applicant's corner (pg 249, col 2 and Fig 1).

Chen (US 6,194,284) teaches a first anisotropic etch into the substrate layer **12** and a second isotropic etching to produce an isotropically etched trench with a greatly diminished number of surface asperities on a smooth trench surface, this reads on applicant's further removing portions of the material adjacent to the region (col 4, ln 10 to col 5, ln 20).

11. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew J Song whose telephone number is 703-305-4953. The examiner can normally be reached on M-F 9:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 703-305-2667. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9310 for regular communications and 703-872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0661.

Matthew J Song
Examiner
Art Unit 1765

MJS
August 11, 2003

NADINE G. NORTON
PRIMARY EXAMINER